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This information is provided to assist field personnel in the safe performance of water quality data collection. Field work requires an awareness of potential hazards and a knowledge of basic safety procedures. Field personnel routinely come in direct and indirect contact with waterborne pathogens, chemicals, and potentially hazardous plants and animals. Safety is nothing more than using common sense and being aware of your surroundings. Advanced planning can eliminate many safety hazards or at least reduce them.

Basic Safety Preparation

Basic preparations should become routine before every sampling activity. At a minimum, a trip plan should be completed for each field trip and left at a designated location in the office. The trip plan should include the following information:

- Field trip participants including guests and observers with emergency contact information
- Departure and return time(s)/date(s)
- Hotel information and contact phone numbers (for overnight trips)
- Basic itinerary including where and when sampling will occur
- Phone numbers for cellular phones or radio frequencies

Field work should be done in pairs. Always carry a cellular telephone or other communication device.

Carry basic safety equipment; first aid kit, flashlight, boots, rain gear, and antibacterial soap or hand cleaner.

Be aware of changing weather conditions and the potential for flash floods, storms and/or tornados.

Be aware of potential hazards at a monitoring site.

Make it a habit to carry a packet of general safety information in each vehicle or boat:

- Material Safety Data Sheets (MSDS) for preservatives
- Basic first aid protocols
- Emergency phone numbers
- Locations of emergency facilities (hospitals, police and fire departments, U.S. Coast Guard)

Use the following checklist to ensure all appropriate safety equipment is available during a sampling trip.

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Basic Safety Equipment Check List	
Check List	**Safety Items**
□	Waders/hip boots/rubber knee boots
□	Personal floatation device (PFD)
□	First aid kit
□	Fire extinguisher
□	Flashlight and spare batteries
□	Cellular phone/Marine radio
□	Rain gear
□	Hat/sun screen/sunglasses
□	Drinking water/sports drinks
□	Safety cones/orange safety vest (working on bridges)
□	Tool box with basic tools
□	Antibacterial soap or hand cleaner
□	Spill kits (for preservatives)
□	Material Safety Data Sheets (MSDS) for preservatives
□	Hand held eye wash unit
□	Protective goggles
□	Container to carry preservatives
□ □	List of emergency phone numbers/office contacts
□	
□	
□	
□	
□	

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Personal Flotation Devices (PFDs)

Approximately 90% of all boating fatalities are drownings. Virtually all drowning victims are not wearing PFDs or are wearing inadequate ones. All boats must be equipped with U. S. Coast Guard approved life jackets or PFDs. The quantity and type depend on the length of the boat and the number of people aboard. PFDs must be in good condition. Regularly test the buoyancy in shallow water or a swimming pool. Inspect the PFDs for weakened material or insecure snaps or zippers. Replace spent cartridges in inflatable PFDS or tag used cartridges as out of service so they are not used accidentally. Ensure all PFDs are the proper size for the intended wearer. Read the label to ensure it is the right size for a person=s weight and chest size. Keep all PFDs readily accessible. All sampling personnel should wear PFDs when in boats and when wading. For boats 16 feet or longer, keep an extra Type IV PFD, in addition to those required for passengers, immediately available.

Select PFDs that are appropriate for the area being sampled.

Type of PFD	Conditions of Use	Positives	Negatives
Type I	Offshore work or remote areas where rescure may take awhile	Excellent for flotation and will turn most unconscious persons face up in the water.	–
Type II	Near-shore vests	Good for calm waters and fast rescues.	Lack the capacity to turn wearers face up.
Type III *	Vests or floatation aids	Good for calm waters and fast rescues.	They will not turn an unconscious person face up and should not be used in rough waters.
Type IV	Throwable devices - cushions or buoy rings	Designed to be thrown to someone in trouble.	Not good for long hours in the water, rough water, non-swimmers or the unconscious.
Type V *	Type V or special use devices are designed for specific activities. They are only appropriate for use in accordance with the specific instructions on the label of the device.		
Note:	* Some Type III and Type V PFDs are designed to inflate when the wearer enters the water. This type must be worn when underway to be acceptable.		

Transporting Chemicals

Ensure that Material Safety Data Sheets (MSDS) are available for all chemicals used on a trip. MSDS provide information on signs and symptoms of exposure, first aid procedures, and spill clean up information. Protect field staff by securing all chemicals using a container that will resist and contain the material in event of an accident. Use an overpack container (e.g., ice chest) to protect against breakage and spills. The most common and dangerous chemicals carried during sampling trips are sulfuric and nitric acids. Carry a spill kit containing neutralizing agents in case of a spill.

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Label all chemical containers clearly and have MSD Sheets available. Include a hand held eye wash in a chemical safety kit whenever chemicals are part of the sampling plan. Consider using ampules of sulfuric and nitric acid in the field instead of transporting large containers of acid. Although there is always a chance of a spill, the risk is significantly reduced by using ampules. Do not pipette by mouth. Always use mechanical pipetters or pipette bulbs.

If extra containers of gasoline are used, ensure that they are transported and stored in approved containers. When filling gas cans on the bed of a metal truck, be sure to ground the container before filling with fuel. When filling portable tanks on a boat, remove them from the boat first. Touch the fuel pipe or tank with the spout to prevent build up of static electricity. Do not fill the tank completely full; leave room for the gasoline to expand. Cap tanks tightly to prevent vapors from escaping. Clean up spills immediately and air used rags before storing them. Store containers in a well ventilated area away from the engine.

Wading (USGS, 1997)

Do not attempt wading in a stream where the depth multiplied by the velocity is equal to or greater than 10 ft^2/s; (Stream Depth) x (Velocity) ∃ 10 ft^2/s. For example, a stream only 2 feet deep with velocities of 5 ft^2/s or more can be dangerous (USGS, 1997).

Always wear a Coast Guard approved PFD while wading. Although the stream may not appear deep, depressions, holes, or loose footing may cause a fall.

Wear hip boots or chest waders. Boots and waders provide protection against cold, contaminants, and under water objects. Be aware of the possibility of slipping and going underwater (feet up, head down) while wearing them.

Avoid hip boots with tight ankles and waders with tight fitting tops. They are difficult to remove in an emergency. Wear a Coast Guard approved PFD whenever chest waders are used.

Be aware of surrounding conditions. Watch for floating debris, areas of quick sand, and deep pools. Watch the stream stage, especially if there is a chance it could rise rapidly.

Working from Bridges

A significant amount of sample collection is done from bridges. This is very dangerous so take steps to minimize the risk. Some basic safety equipment for bridge sampling should include reflective vests, orange safety cones, and a revolving amber light. Check with the California Highway Patrol/Dept. of Transportation, as an activated flashing or revolving light on vehicles may be required (and is advised) for short-term, short-duration (60 minutes or less) work on the road shoulder. For vehicle parking on the shoulder for longer than 60 minutes, orange safety cones should be used in addition to the flashing amber light. The cones should begin from 40 feet before the vehicle where the posted speed limit is 30 miles per hour (mph) or less, up to 250 feet before the vehicle where the speed limit is 70 mph.

If the field vehicle is parked on the bridge, never stand in front of it while sampling. Field staff can not see traffic and drivers can not see field staff. Set up sampling away from the vehicle where traffic from both directions can be observed.

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Be aware of any boat traffic.

Wear a Coast Guard approved life jacket when working on bridges over large rivers. This is particularly important at sites where USGS gauges, positioned over the water, require climbing over the sides of bridges and down a ladder.

Working from Boats

Know the boat=s capacity. Look for a capacity plate near the operator=s position or on the transom. This plate indicates the maximum weight capacity or the maximum number of people the boat can carry safely. Maximum weight includes the combined weight of passengers and gear.

On outboard powerboats, the capacity plate will also show the maximum horsepower rating of the boat. Do not exceed this rating.

Use caution when refueling a boat. Check the entire fuel system for leaks, and tighten connections frequently. Turn off the engine and all electrical equipment before adding fuel to the tanks. If the boat is equipped with a power ventilation system, turn it on for at least four minutes before starting the engine to clear gasoline vapors from the bilge. Never smoke or strike a match while fueling or near a fueling dock.

Leave a trip itinerary for each boat trip at a designated location in the office. The plan should include :

- Date and purpose of the trip
- Name of operator(s) and any guests or observers with emergency contact information
- Destination and route to be taken
- Time of departure and estimated time of return
- Cell phone number or radio frequency
- Type of boat including color, length, identification number and any other unique features

Make sure the boat is in good operating condition and full of gas before taking it out on the water. Use the following check list to ensure the boat is ready for use.

Check weather conditions before departure. If a storm comes up while on the water, head for shore. Always carry a marine radio or cellular telephone. Boating should always be done in pairs.

Do not wear waders and hipboots in a boat. because they could be a safety hazard if the boat should tip or a person is thrown out. Always wear a Coast Guard approved life jacket.

Operators of vessels involved in any collision, accident or other casualty that results in death or injury to any person or property must file a complete report of the accident. Keep in mind that vessel operators involved in a boating accident must stop and render whatever assistance is necessary unless such actions would endanger their own vessel, crew, or passengers. Operators must give their name, address, and vessel identification number in writing to any injured person and to the owner of any damaged property.

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Boating Safety Checklist			
TRAILER	YES	NO	Comments:
Size of coupler and ball hitch match			
Tire pressures are at the maximum noted on the rim			
Tires treads are at least 3/32"			
Tires are in good condition			Show no bulging, cracking, or tread separation
Brake lights and turn signals function			
Safety chains are attached in an Ax≅ under the coupling			
All boat straps are tight			
License plate is present and firmly attached			
Trailer stand is secure			
BOAT	YES	NO	Comments:
Boat plugs are present			
Battery is charged			
Gas tank is full			
Anchor and rope are aboard			
Navigation lights operational			Lights are appropriate for boat size, no other lights that may be mistaken for navigation lights are exhibited
Emergency paddles are aboard			
First aid kit available			
First extinguisher is charged and accessible			
Flashlight with working batteries is available			
An air horn or whistle is aboard			
Rain gear is aboard			
Personal floatation devices are			

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available for every person on board			
The emergency kill switch for the boat motor is functioning			
Radio or cell phone is available and functioning			

Electrofishing

Electrofishing is hazardous work. The batteries and generators used provide more than enough current to electrocute a person. **Use extreme caution**. ***Never electrofish alone***. Ensure that everyone associated with the electrofishing efforts is aware of the hazards and safety requirements before beginning the project. Remember to notify California Department of Fish and Game of the electrofishing effort and obtain a Scientific Collection Permit before the trip.

Be familiar with the equipment and inspect it before each use. Correct any equipment problems immediately.If equipment must wait to be repaired, tag it AOut of Service≅ so it won=t be used accidentally. Evaluate the equipment annually during a preventative maintenance inspection. Do not allow wiring splices. If connections are necessary ensure that the rating of the connector is the same or greater than the wire. Ensure all junction boxes are weatherproof or rain tight depending on the use. Junction boxes with switching equipment must be weatherproof. Ensure that batteries used on backpack electrofishing units are a gel type that will not leak when tipped or overturned. Check hip and shoulder straps to make sure they are a quick release type, are not damaged, and are sufficient in length for the person who will use them. Ensure that the backpack unit is equipped with a tip switch that breaks the circuit if the user falls. This switch must be the type that is manually reset before reestablishing the circuit.

Ensure at least one member of the crew is trained in CPR.

All personnel must wear Coast Guard approved PFDs and rubber gloves rated for a voltage above that used by the electrofishing unit when in electrofishing from the boat, with no exceptions. Rubber knee boots are also recommended for boat electrofishing.

Wear waders and rubber gloves rated for a voltage above that used by the electrofishing unit when backpack electrofishing.

Inspect all nets to ensure they are made of non-conductive material and that they are long enough to keep the user=s hands out of the water.

Contaminated Water

Always consider the possibility that the water being sampled may be contaminated with pathogens or hazardous chemicals. Use caution and extra protection when working in or around water with known or suspected contamination. A more detailed protocol for sample collection in areas with known or suspected contamination, for pathogens and bacteria particularly, will be added to this guidance soon.

- Use sample tags to indicate the level of contamination so the laboratory can handle the sample appropriately.

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- Communicate known or suspected contamination to all personnel who could come in contact with a contaminated sample.

Waterborne, disease causing organisms (pathogens) are found in nearly all surface water systems. Pathogens enter surface water through untreated sewage discharges and bypasses, storm and agricultural runoff, and direct contact. Bacteria, viruses and other pathogens can occur in the most pristine environments.

- Never drink sample water, no matter how pristine the environment appears. Consider making antibacterial soap or hand cleaner a routine item carried on all field trips.

As a further precaution, a medical monitoring program is recommended for all sampling personnel.

- This program should include an annual health history and physical, respiratory monitoring, hepatitis A and B vaccines, and a tetanus vaccine with a booster every 10 years, at a minimum.

Weather

Weather can change rapidly and create unexpected situations for sampling personnel whether in a boat or in isolated sampling areas. Check local weather forecasts frequently. Be alert to visual weather cues such as developing clouds, wind shifts, and greying skies.

When in a boat head for shore immediately. Head the bow into the waves at a 45 degree angle. Reduce speed, but keep enough power to maintain headway. Seat passengers on the bottom of the boat, as close to the centerline as possible.

Leave small creeks and rivers to avoid flash floods. Don=t cross low water crossings as the integrity of the underlying roadway is uncertain. Floating debris may damage the vehicle or even push the it from the road way.

Temperature Exposure

Extremes of air temperature occur in all parts of the country. The ideal comfort range for humans is between 10 to 32EC (60 to 90EF). Hypothermia (cold) and hyperthermia (heat) normally occur outside this range.

Cold Emergencies

Hypothermia is a condition of reduced body temperature caused by exposure to cold, and aggravated by wet clothes, wind, hunger and exhaustion. Hypothermia can occur with air temperatures above 16EC (60EF) under wet and/or windy conditions.

Warning Signs	Uncontrollable fits of shivering, incoherence, listlessness, fumbling hands, frequent stumbling, drowsiness, and the inability to get up after resting.
Treatment	Remove person from cold and get to a dry warm place. Replace wet clothes with dry. Warm body slowly. Give warm non-alcoholic drinks. These are temporary measures until medical help arrives.

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Prevention	The best way to prevent hypothermia is to stay warm and dry. Put on rain gear before it rains. Dress in layers and add more before getting cold. Find shelter before conditions become severe. During colder weather carry a complete change of dry clothes.

Heat Emergencies

Hyperthermia is caused by increasing body temperature due to exposure to extreme heat. Heat emergencies can be brought about by a combination of factors; physical exertion, clothing (waders), humidity, no breeze, air temperature, and the rate of fluid intake. Working in the extreme summer heat creates a very real threat of suffering from some form of heat related stress.

Warning Signs	Chilling, headache, unsteadiness, dizziness, nausea, dry skin (either hot and red [heat stroke] or cool and pale [heat exhaustion]), rapid pulse and muscle pain/spasms.
Treatment	General treatment for heat emergencies is cooling down and drinking plenty of fluids. **Do not take salt tablets**. A common symptom of dehydration is a headache. Heat stroke requires immediate medical attention and can cause death. Cool down victims of heat stroke quickly and watch for signs of shock. Call 911 or, if in an isolated area, transport the victim to a medical facility immediately.
Prevention	Hydrate well before working outdoors. Drink water in moderate amounts every fifteen minutes. Do not rely on thirst to indicate dehydration. Avoid alcohol, caffeine, and soda. These liquids are not water substitutes and can increase the rate of dehydration. Wear lightweight, light colored clothing and a wide-brimmed hat. Schedule activities that require the most exertion during early morning or late afternoon hours. Find some shade and take breaks during the day.

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Plants and Animals

Insects, reptiles and certain plants are always potential hazards for field personnel. The following is a summary of general information on the most common plant and animal hazards encountered by field staff (American Red Cross 1988; USGS, 1997; Milne and Milne, 1980; and Behler and King, 1979).

Animals	**Descriptions/Characteristics**	**Procedure** (ARC 1988; USGS 1997)
SPIDERS, SCORPIONS and OTHER INSECTS (Milne and Milne, 1980; USGS, 1997)		
Black widow spiders	Female (only one that bites) is black with almost spherical, usually with red hour glass mark below or with 2 transverse red marks, separated by black. Inhabit fallen branches and under objects. Red and brown widow spiders are less common but inhabit the western U.S.	Take care when reaching into small dark spaces. If bitten by a black widow or brown recluse, seek medical attention as soon as possible. Scorpion stings may not require medical attention.
Brown recluse spiders	Orange-yellow thorax with dark violin pattern. Bases of legs orange-yellow, rest of legs grayish to dark brown. Abdomen grayish to dark brown with no obvious pattern. Frequent areas of human habitation and prefers dark spaces. Found outdoors in sheltered corners, among loose debris; indoors on the floor and behind furniture.	
SPIDERS, SCORPIONS and OTHER INSECTS (Milne and Milne, 1980; USGS, 1997)		
Scorpions	Lobster-like pincers with a long up curved Atail≅ that ends in a poisonous stinger. Nocturnal, sensitive to vibrations. Frequent the desert. Not easily seen in the wild. Field boots are a favorite hiding place. Most scorpions are not dangerous and do not attack. Poison of most North American species is not lethal to humans but they do inflict a painful sting.	
Ticks	Small, less than 3 mm (< 1/8 inch). Clamps to host using dart-like anchor located just below the mouth. Wear long pants and tuck pants legs into socks and use a repellent containing the compound DEET (N-diethyl-meta-toluamide).	X Check for ticks during and after field work. X Remove with tweezers within 24-hours. X Wash and disinfect the bite.
Bees	Bees vary in size from 2 mm (0.08 inches) to 4 cm (1.6 inches) long. Locations vary from ground nests to trees and manmade structures.	X Avoid bee hives and wasp nests. X Scrape off the stinger with a knife or other flat object (i.e., credit card). X Wash well with soap and water. X A cold pack may be used to reduce swelling. X Use an over the counter sting ointment or solution

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Animals	**Descriptions/Characteristics**	**Procedure** (ARC 1988; USGS 1997)
		of water and baking soda.
Wasps	Wasps vary in size from minute to 5 cm (2 inches) long. Adults have a narrow waist between the first and second abdominal segments. Locations vary from ground nests to trees and manmade structures.	X If a member of a field team is allergic to insect bites or stings this should be made known to the rest of team. That person should carry a sting kit for use in emergencies. X Symptoms of an allergic reaction include: pain, swelling of the throat, redness or discoloration in the area of the sting, itching, hives, decreased consciousness, or difficult or noisy breathing.
SNAKES (Behler and King, 1979; USGS, 1997)		
Copperhead	**Description**: Stout body; copper, orange, or pink tinged with bold chestnut or reddish brown crossbands narrowing in the middle of the back. Top of head unmarked. **Habitat**: Wooded hill sides with rock outcrops above streams or ponds, edges of swamps and periodically flooded coastal plains; near canyon springs and dense river cane stands along the Rio Grande. Seen basking during fall and winter months but more nocturnal during warm weather. Favorite warm weather habitats include stonewalls, piles of debris, rotting logs, and large flat stones near streams. **Hazard**: Copperhead bites are painful but rarely life threatening.	Best defense is to avoid them. Most snakes will go the other way unless unusually agitated or disturbed. Take care when electrofishing and seining near log jams, fallen trees and undercut banks.
Cottonmouth (water moccasin)	**Description**: A dark, heavy-bodied water snake. Broad-based head noticeably wider than neck. Olive, brown or black above; patternless or with jagged-edged dark crossbands. Top of head is flat; eyes not visible from directly above as in other harmless water snakes. Unlike other water snakes, it swims with head well out of water. Never far from water. Most active at night although may be seen sunning during the day. **Habitat**: Lowland swamps, lakes, rivers, bayheads, irrigation ditches, canals, rice fields, to small clear rocky mountain streams. Do not disturb. **Hazard**: Bite more serious than that of a	If bitten: **Do** X Reassure the victim X Treat for shock. Keep victim lying down; elevate feet 10 to 12 inches. X Seek medical attention as soon as possible. **Do Not** X Cut and suck bite area. X Apply ice or a tourniquet

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Animals	**Descriptions/Characteristics**	**Procedure** (ARC 1988; USGS 1997)
	copperhead and can be fatal. When disturbed, tend to stand its ground exposing the light Acotton≅ lining of its mouth.	X Leave victim unattended.
Rattlesnakes	**Description**: Heavy-bodied with heads distinctly wider than the neck. Most have blotches or crossband patterns on the back. (The diamondback has black bordered diamond patterns or hexagonal blotches. Two diagonal lines on side of face. Tail encircled by broad black and white rings.) They have recurved, retractable, hollow fangs near the front of the upper jaw. Rattlesnakes have a distinctive rattle on the tail. **Habitat**: Arid and semiarid area from plains to mountains; brushy desert, rocky canyons, bluffs along rivers, sparsely vegetated rocky foothills. **Hazard**: Western diamondback rattle snake is capable of delivering a fatal bite. When disturbed it normally stands its ground, lifting its head well above the coils. The warning is a buzzing sound.	
Coral snakes	**Description**: Distinctly colored with wide red and black bands separated by a narrow, bright yellow or white band. *Red and black bands never touch*. Several harmless snakes have similar color patterns (scarlet kingsnake and scarlet snake). The head is black and the snout is blunt. **Habitat**: Moist densely vegetated upland areas near ponds or streams in hardwood forests; rocky hillsides and canyons. Usually seen under rotting logs or leaves. May be seen moving on the surface in early morning or late afternoon. **Hazard**: Unlike the vipers and pit vipers, enlarged grooved fangs are fixed in position on the front part of the upper jaw. Coral snakes must Achew prey.≅ The venom is a strong neurotoxin and bites can be fatal.	If bitten: **Do** X Reassure the victim X Treat for shock. Keep victim lying down; elevate feet 10 to 12 inches. X Seek medical attention as soon as possible. **Do Not** X Cut and suck bite area. X Apply ice or a tourniquet X Leave victim unattended.

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Animals	**Descriptions/Characteristics**	**Procedure** (ARC 1988; USGS 1997)
PLANTS		
Poison Oak and Poison Ivy	Climbing poison ivy has alternate, trifoliate leaves with aerial roots that grow straight and are fuzzy. Found in most environments. Non-climbing poison ivy lacks aerial roots. The leaves are the same shape as the climbing poison ivy but are larger and broader. Poison oak is prolific in California, and like Poison ivy, has alternate, trifoliate leaves. These leaves also turn orangish-red in the fall. Poison oak plants are bushy and twiggy, and are often found along trails, along fence lines; they can also be found intertwined around large trees. Vines or twigs/branches without leaves can still cause a case of poison oak or poison ivy. If a piece of vine or twig/branch is used as fire wood, the oily resins can be released into the air. The resin can also remain on unwashed clothing and equipment.	**Do** Flood the affected area with lots of cold water as soon as possible. Since the oily resin is only slightly soluble in water, a little water will only spread the poison. Use anti-itch cream. People allergic to poison ivy or poison oak may require medical attention. Consider using pre-exposure lotion which creates a barrier against poison ivy, oak and sumac oils. Poison oak and ivy cleansers are available that can be used up to 8 hours after exposure. **Do Not** Use hot water or soap. These help increase the affects of poison ivy and poison oak.